Chapter 3
Sockets and End Terminations

Sockets and end terminations are of great importance in regards to efficiently transferring force from the drum, through the wire rope, and to the gate. They can have a significant effect on the service life of a rope. Each type of socket or termination has its individual characteristics, and one type will usually fit a given installation better than the others. Their strength varies and not all will develop the full strength of the rope (See Section 4-5, "Factor of Safety"). This chapter presents various sockets, drum terminations, and miscellaneous terminations along with information on cutting and splicing wire rope. This chapter also presents information on the option of using two-piece ropes.

3-1. Sockets

a. General. Sockets are normally used at the gate end of a wire rope, and they must develop 100 percent of the strength of the rope. It should be noted that sockets are not normally reused.

b. Swaged sockets. Swaged sockets are mechanically pressed onto wire rope (Figure 3-1). They are occasionally used for gate-operating devices. If properly designed and attached, they can develop 100 percent of the strength of the rope. Note that swaged sockets are not suitable for lang lay rope, nor are they suitable for ropes with a fiber core.

c. Speltered sockets. Speltered (or poured) sockets are attached to wire rope with zinc or resin (Figure 3-2). They are normally specified for the gate end of a rope. They are best where the rope is in straight tension, that is, where the load does not touch the rope (Figure 3-3). Both zinc-filled and resin-filled sockets develop 100 percent of the strength of the rope if attached correctly. In fact, speltered sockets are normally used for wire rope strength testing. Zinc fill is the old standard. However, epoxy fill appears to be better in almost every respect. Also, it is recommended that speltered sockets be proof loaded prior to use.

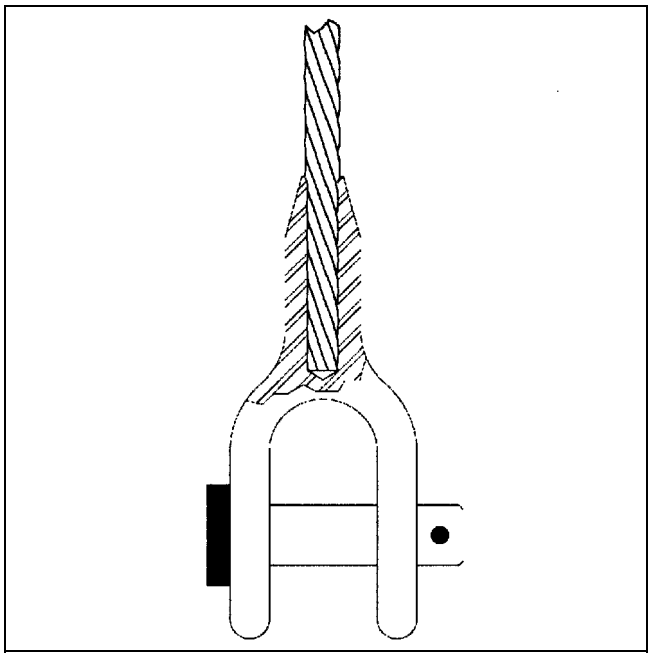

Figure 3-1. A swaged socket: Like speltered sockets, they can develop 100 percent of rope strength

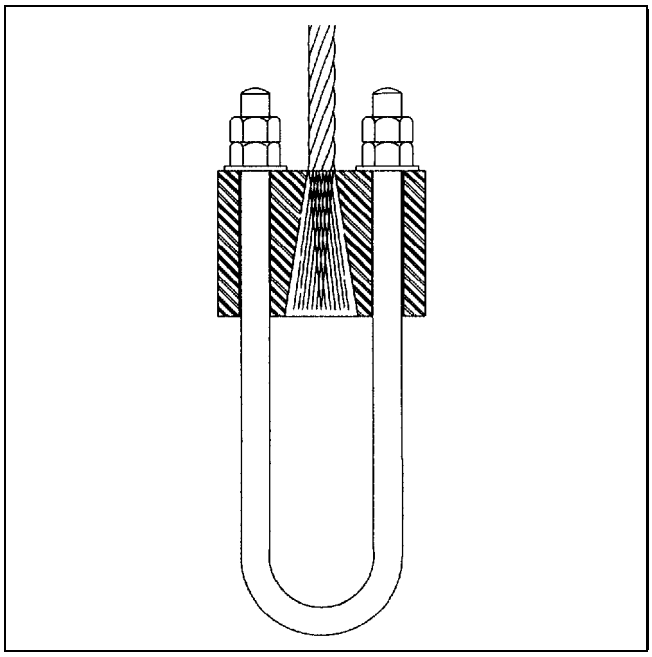

Figure 3-2. A speltered socket: This type socket can develop 100 percent of the strength of a wire rope

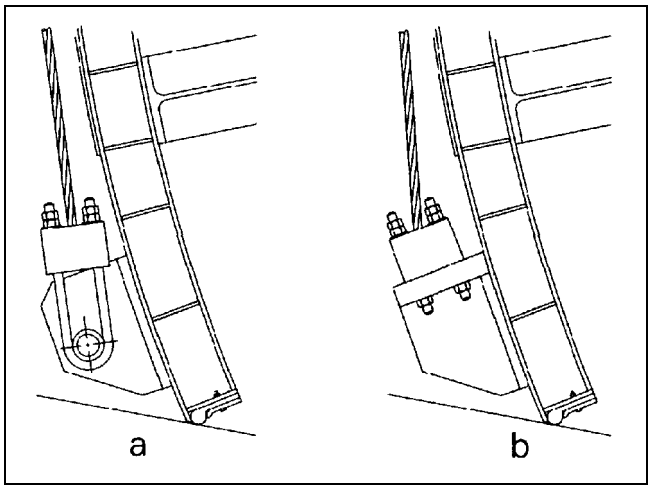

Figure 3-3. Wire rope should be in straight tension out of a socket: (a) correct - socket can rotate, and (b) incorrect - rope is required to bend

d. Installation. It is recommended that swaged and speltered sockets be attached at the rope manufacturer's facilities. Swaged sockets are frequently installed by the rope manufacturer as qualified personnel, proper dies, and heavy hydraulic presses are required. A great deal of expertise is needed for attaching both swaged sockets and speltered sockets. The rope must be well aligned with the socket and the rope strands must have uniform tension. In attaching speltered sockets, cleaning before pouring zinc or epoxy can be difficult in the field. Poor cleaning can result in a weak socket. Also, the proof loading with sockets in place prior to use is more readily accomplished at a rope manufacturer's facilities. Although socketing is best left to experts, note that socketing information is presented in the Wire Rope Users Manual. Also note that some sockets for gate-lifting devices are a custom design.

3-2. Materials/Coatings

If swaged or speltered sockets and their ropes are of dissimilar materials, and are located under water or in wet environments, they will likely fail from galvanic corrosion. The designer/specifier must consider materials and coatings in regard to selection of the sockets for wire rope. It is important that the socket and spelter material are galvanically compatible with the rope. That is, they all need to have approximately the same galvanic potential. A stainless steel rope attached to an epoxy-filled speltered socket of a compatible stainless steel width would be ideal, as would a galvanized rope attached to a galvanized steel speltered socket. Coatings can be used to protect the more reactive element of the rope/socket combination but are not recommended. Sockets can be coated with insulating materials, either on the inside for galvanic isolation from the rope or on the outside for protection from the environment. However, coatings are susceptible to problems from poor installation and damage from nicks, cuts, and wear. Additionally the designer/specifier should consider the materials for pulleys or gate areas in contact with the rope. A submerged carbon steel pulley in contact with a stainless steel rope will probably pit, and may cause significant abrasive wear to occur on the rope.

3-3. Drum and Miscellaneous Terminations

a. Drum anchorages. Most drum anchorages for gate-operating devices feature bolt-on-clamps or wedge-type sockets. They are usually designed by the drum/equipment manufacturer. Alone, their efficiency may not be as high as required, but in combination with at least two dead wraps of the rope, and preferably three, they should develop 100 percent of the strength of the rope (Figure 3-4). This is true for grooved, plain, and multiple layered drums (Appendix D).

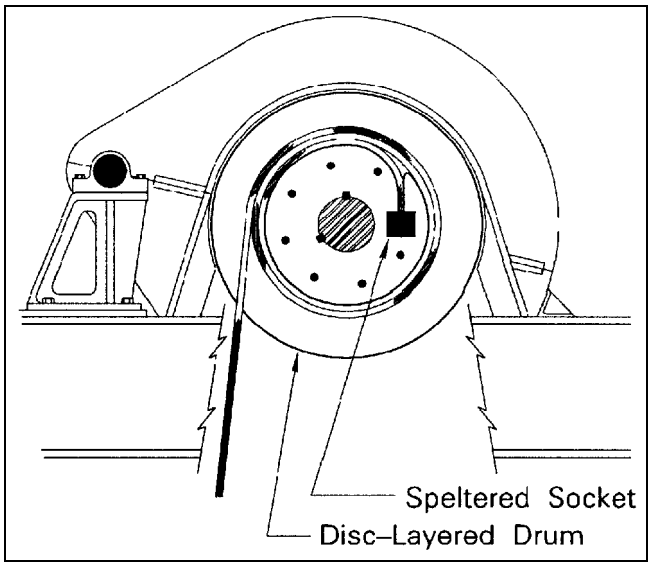

Figure 3-4. Drum anchorages featuring clamps will develop 100 percent the strength of the rope, if two or preferably three dead wraps are made

b. Miscellaneous terminations. There are a number of end terminations which are less efficient than swaged sockets, speltered sockets, and drum anchorages. They include clamps, clips, wedge sockets, etc. Their use on gate-operating devices is not recommended because of their lower efficiencies, which generally range between 70 and 80 percent (Figure 3-5 and Section 4-5, "Factor of Safety"). Also note that most of these type fittings should not be reused as a rope's wires will swage into their metal mating surfaces. They only provide the proper rope grip during the first use.

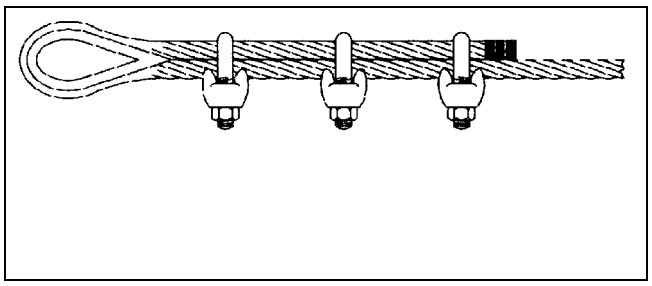

Figure 3-5. A clamped termination

3-4. Seizing/Cutting/Splicing

a. General. Seizing, cutting, and splicing wire rope, except at the rope manufacturer's facilities, is discouraged. This is especially true for splicing. However, there may be times these procedures must be performed in the field.

b. Seizing. Proper seizing is required prior to cutting wire rope. The seizing must be placed on each side of the cut. Failure to adequately seize a rope will result in problems such as loosened strands, distorted and flattened ends, and eventual uneven load distribution. Information on methods of seizing is given in the Wire Rope Users Manual.

c. Cutting. Cutting is reasonably simple if the proper tools are used. There are several types of cutters and shears commercially available which are specifically designed to cut wire rope. Although it is a common practice, wire rope should not be cut with a torch.

d. Splicing. Splicing is not a recommended practice for gate-operating devices. The efficiency of a spliced rope is likely to be very low. Information on splicing is given in the Wire Rope Users Manual.

3-5. Two-Piece Ropes

There are potential benefits for using two-piece ropes for some applications. For example, an existing carbon steel wire rope on a gate-lifting device may occasionally or usually be submerged at its gate end. The gate end will normally corrode severely, but the rest of the rope will not. The existing one-piece rope could be replaced with a two-piece rope. The longer upper section would be attached to the drum. It would always be above the water line, and would provide a long service life even if made of carbon steel. A shorter section would be used for the gate end. If the shorter section could be made of carbon steel, it would be replaced often, but at a much lower cost than replacing the previous one-piece rope. Another option would be to make the short piece of stainless steel. This would provide a longer service life at a lower overall cost than a one-piece stainless steel wire rope. It is recommended the connection between the two ropes be designed for replacement without having to re-socket the rope attached to the drum. It is also recommended the upper rope section be long enough so the connection does not contact the drum or sheaves when the gate is in the fully open position. Purchasing more than one gate-end rope per drum-end rope should be considered. The major disadvantage to the two-piece rope concept would be the cost for extra sockets and socketing.